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AUTHOR Alpert, Daniel
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ABSTRACT

Concern for changes in the environment in which we live and the need for change within universities to realistically meet the expectations of society are explored in this speech. Education, research, and public service, representing three inseparable aspects of the overall mission of the university, are of foremost consideration. The nature of national objectives for research and development on problems posed by society is assessed, with new and better ways of providing education as one of the goals. This is followed by attention to the structure of the university, asking whether our present form is appropriate for the functions of a modern university. The case is made that we must continue the departmental structure to maintain intellectual leadership in the major fields of human knowledge. But new, flexible organizations or interdisciplinary units are needed which may pursue differenct objectives without subordinating one administrative structure to the other. Lastly, the life style of the faculty is questioned. Is it possible to construct campus mechanisms for developing interdisciplinary capability, encourage faculty members to explore other career opportunities, and bring onto campus people with experience in industry or government who do not have the credentials of an academic professor? (BL)

UNIVERSITY RESEARCH ON PROBLEMS POSED BY SOCIETY

Daniel Alpert, Dean
The Graduate College
University of Illinois at Urbana-Champaign *

The period from 1945 to 1965 was a time of remarkable growth for major American universities--growth in physical size, in affluence, and in prestige. Particularly in the fields of science, which we proceeded to dominate in the production of papers, of Ph.D.'s, and of Nobel Prize winners, American universities led the world. The influence of professors in industry and government rose to an all-time high. Yet when I returned to the university in 1957 after a career in industry, there were already many signs that between the expectations of society and the ongoing activities of the university there had arisen major disparities which would soon subject all institutions of higher learning to radical new tensions.

On the one hand, there seemed to be a generally held consensus that solutions to the emerging social problems of the post-war era could be achieved through the dissemination of knowledge or the acquisition of new knowledge; institutions of education were presumed to hold the key to the increasingly complex problems of the times. On the other hand, to this newly arrived observer, it seemed not at all clear that the knowledge we were transmitting or the new knowledge we were seeking held valid promise of providing answers to the truly difficult problems of the times. The goals of individual faculty members often seemed to be unrelated to the stated or unstated goals of the educational institution, which in turn seemed to be quite out of touch with either governmental sponsors or student clients. A detached observer at that time would have wondered what

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the goals of the university were and how the many purposes which it encompassed could be related to society through the governing structure which had evolved.

The tenuousness of the consensus about the goals and governance of the university was suggested in some prophetic comments by Clark Kerr in his famous Godkin lectures in 1963: "The university" (he called it "multiversity") "means so many things to so many people that *it must of necessity be partially at war with itself.*" The uneasy consensus blew up with a loud bang at Berkeley only a year later. Soon confrontations arose on virtually every campus in the nation. Since that time, a reconsideration of the purposes and structure of our universities has become a national pastime. This soul-searching is absolutely essential to the development of a new consensus and a new perspective on the future role of the university.

My remarks this evening are addressed to changes in the environment in which we live and to the need for change within the university. They are especially addressed to the role of the university in dealing with the real and complex problems facing us as a nation. I am fully aware that there are some on the campus who will question whether the university should play such a role, and I do not want to prejudge the outcome of possible debate on this issue. Some colleges and departments will undoubtedly decide to continue in a familiar pattern to train experts in the traditional disciplines and in the existing professions. There is every reason for them to do so. On the other hand, there are at least three reasons why many universities will make a serious attempt to organize new efforts aimed at solving problems posed by society today:

1. There is a growing concern at the loss of grass-roots support of the university, a support which has been taken for granted

until the past few years. For the land-grant university, such public support in the past was sustained in no small measure by efforts within the university to solve grass-roots problems.

2. Our students are increasingly interested in and concerned with such problems. At their best, recent student demands for "relevance" represent an appeal for education which enables graduate to work on major societal problems or to develop professions which would enable them to do so.

3. The problems facing society at this point in history are critical; the development of viable means for dealing with them may well determine whether or how mankind will survive. At this point in time we do not understand many of the problems; we do not even know what forms of institutions or institutional relationships will be needed to attack them.

I think it essential that we maintain our strength in the traditional disciplines, which act as custodians of the intellectual standards of our society. To transmit knowledge and to acquire new knowledge are prime functions of the university; to carry them out we must maintain intellectual leadership in the major fields of human knowledge and in their long-term application. We must recognize the great strength of the departmental structure in providing such leadership.

However, in addition to disciplinary scholarship and leadership in basic research, the university must also address itself to the problems facing society. And we must do so, not because the survival of society depends solely upon the university, but because the survival of the university depends upon the confidence of both students and the general public in the university's readiness to play a valid role in seeking understanding of

social problems.

Concern over the university's purposes is arising in a period of changing national goals. In a recent study carried out by a committee of the National Academy of Sciences and the National Academy of Engineering, an important distinction is made among national goals for research and development (R&D). I quote from the report:

> In the consideration of national policies for R&D, it is important to distinguish between two major categories of national goals for R&D, in the context of which further recommendations are made:
>
> > *Central National Goals for R&D*--such as leadership in the important fields of science, nuclear power, space exploration, and national defense--in which the program is national in focus, sponsorship, funding, and overall direction.
> >
> > *Distributed National Goals for R&D*--such as the development of human resources, the rebuilding of our cities, water resources, and regional environment for living--in which the programs are characterized by local determinants in the nature of the problems, in the approach to solutions, and in their anticipated consequences. *[I will say more about this later: in particular that these problems are also characterized by local variations in clients and sponsors of the R&D.]*
>
> These goals, while related in many areas, require distinctly different criteria for establishing priorities and means for implementation.

It is important for today's discussion to recognize that *central national goals* represent the principal rationale for the great enhancement of federal support for the universities during the post-war period. Relatively little support was given for graduate education as such. Most of the support was provided by mission-oriented agencies whose purpose in each case was addressed to a central national problem. One principal motivation in the 50's and 60's was fear of external enemies. Not only the Department of Defense, but even the Office of Education through the National

Defense Education Act greatly stimulated the buildup of the physical sciences and many other fields, including the life and social sciences. Now, however, our nation's attention is obviously turning from a preoccupation with central national missions, particularly national defense, to a concern with such internal issues as the problems of urban decay, crime in the streets, and pollution of the environment. This shift in attention on the part of our whole society was accelerated through the efforts of the young people of our nation, particularly our students. We should keep this consideration in mind in the discussion that follows.

I think it is very important for us to recognize how differently the university is affected by *central* and *distributed* national goals for research. The buildup of research capability oriented to central goals, while valid for many disciplines and essential to this nation, is not conducive--indeed may be counterproductive--to the development of research capability *for* addressing distributed national goals. In general, the research objectives, the reward system, and the departmental organizational structure of the university have been very well suited to the pursuit of central national goals. Under the impetus of federal project support in disciplinary fields, the university tended to become more national in character and oriented to problems of the federal government in purpose. The pursuit of distributed national goals is much more regional in orientation. The problems of education and development of human capability, the problems of the environment and the urban community are characterized by local determinants in the nature of problems and in approaches to solutions. For a central national goal, the federal agency itself--whether it be the Department of Defense, the National Science Foundation, or the National Institutes of Health--has

the responsibility for relating the research activity and its by-products to the mission of the agency and to society. Thus, in a very direct sense, *the agency is not only the sponsor for such research but it is the client as well.* By contrast, in the case of a distributed national goal, for instance, the development of better agricultural products, the sponsor was a federal or state agency (the Department of Agriculture or the land-grant school), but the client was the individual farmer; and it was the individual farmer who had to be persuaded to plant a new seed corn before society could enjoy a pay-off.

The agriculture experience has often been set forth as an example of university success in solving a distributed or regional problem. However, if we are to deal effectively with the great social problems of today, we should not oversimplify and organize our efforts solely by analogy with previous experience. There are very great differences in the nature of today's problems, in the character of available research tools, and in the nature of the prospective clients and sponsors. In case of a problem like the pollution of Lake Michigan, we should ask such questions as: Who is the client who will make use of the research results? Who will pay for the implementation of solutions? What public bodies are responsible for legislation and control of pollution when several states and many urban communities are involved? These questions indicate that the difficult problems of our times call for far more than a scientific or technological study of a clearly specified problem. They call for an intimate understanding of many political and social constraints, and they call for an *entrepreneurial spirit* in the development of potential clients who have an implicit collective stake in the solution of such problems.

In the case of the agricultural experience, the professor of agriculture as well as his student knew the client and the economic, sociological, and cultural environment in which he lived. Typically, both professor and student had been farm boys who knew the smell of the barnyard. By contrast, the cities and the environment pose problems in which the client is not clearly defined. The citizens from a dozen contiguous communities may be involved. To relate to regional problems, then, we must have not only dedicated sponsors but knowledgeable clients. The client is frequently not an individual but an agency or political unit. Often we must create this clientele, sometimes by persuading many agencies at the local or state level to support jointly a regional enterprise in the public interest.

I have tried to set forth some of the broad characteristics of the problems we face. How should the university community be organized to address such problems? Many professors and laymen alike view our universities as great reservoirs of widely diverse talents ready, able, and willing to tackle difficult problems. No small number of students and professors assume that the only barrier which stands in the way of valid solutions is the availability of sufficient money. "Just stop the war and divert the funds to academic research on social problems and all will be solved." Now while I am completely in favor both of stopping the war and diverting more funds to higher education, I do not believe that the solutions to these problems are obvious, nor that we are limited mainly by the availability of federal dollars. By and large, the problems are mission oriented and can not be solved or even analyzed through the use of methodologies developed in a single discipline. It has become part of the common understanding that a valid attack on such problems will involve many disciplines. But more than that, the problems call for design or synthesis--and often for

alternative plans of action--sometimes on the basis of inaccurate data. In most cases, entirely new approaches to both analysis and design must be invented.

I think it is important at this point in the discussion to call attention to two very different kinds of campus research centers which have played a role in relating various disciplines. These are multidisciplinary centers and interdisciplinary centers. While a sharp distinction between these terms is not conventionally made, I believe it is useful to apply different labels to distinguish between two very different types of activities. I propose the term "multidisciplinary" to describe a center or laboratory in which individual scholars from different disciplines (or departments) share common facilities, common research approaches, or a common environment. Sometimes all they share in common is a "sales pitch," a joint search for federal funds. One example of a multidisciplinary center fulfilling a real university need, the Materials Research Laboratory, includes metallurgists, solid-state physicists and engineers, and solid-state chemists whose work is benefited by the sharing of experimental facilities as well as a congenial intellectual environment. In another multidisciplinary program, specialists in Oriental history, economics, or sociology participate in a Center for Asian Studies in which a key feature is an Asian library collection. It is important to note that in both of these examples the problems tackled by a given scientist or scholar typically do not require the participation of others in reaching a solution. The individual researcher benefits from the shared intellectual environment, joint funding, or common physical facilities, but he works on problems posed by his own discipline.

An "interdisciplinary" center, as I will use the term, has as its prime focus problems which call for the insights of experts in a number of disciplines and which demand an interactive joint effort to reach a solution. The problem is posed by society--not by a discipline. It is the problem that determines the selection of the personnel involved in a given project. If the problem is complex, the approach to a solution requires teams of designers, engineers, or scientists from different fields of specialization. At the Coordinated Science Laboratory, for example, interdisciplinary teams have tackled such problems as the design of a navigation system, an air traffic control system, and a computer-based education system. For each systems project, a different set of disciplinary backgrounds or skills was called for, and a group of professionals assembled, typically under the guidance or leadership of a project head.

It is interesting to contrast the relationships of faculty with graduate students in these different environments. In the multidisciplinary laboratory, the student is assigned to a given professor (or vice versa) and relates to him as he would within the department: the problems are those considered currently valid in the discipline. In an interdisciplinary effort, on the other hand, the student selects, or is assigned, a problem in the context of a much larger group objective. He may become a key member of the group even before he writes his thesis and in the process he may relate to several senior staff members from different departments.

The administration of these two types of centers obviously calls for different skills, different procedures for decision-making, and different reward systems. In the case of a multidisciplinary center or facility, a principal objective is to serve a group of previously selected departments, and the director's prime function is that of coordinator and spokesman.

By contrast, the key administrative challenge in an interdisciplinary effort is the assembly of a group of people who can relate effectively to a problem and to each other. This involves a delicate and skillful selection process, and one in which commitments may be tentative and subject to later change. As opposed to the situation in multidisciplinary laboratories, one often can not predict which departments may be involved, even when it is clear what fields of disciplinary expertise are needed. The motivation for taking part in an interdisciplinary effort differs substantially from that for a traditional departmental program or multidisciplinary laboratory. A problem-solving effort is primarily addressed not inwardly toward a participant's professional standing in his discipline, but outwardly to the successful design of solutions to his problem. For all of these reasons, it should be clear that the administrative task is different; it calls for charismatic leadership rather than coordination, and it is not substantially motivated by the disciplinary reward system, so deeply ingrained in the academic scene.

From the above remarks, it should be apparent why the academic community has found it much easier to understand and to administer the multidisciplinary facility; in simple terms, its major function is to serve the existing disciplines and departments, and our campus community understands this function.

It should also be apparent why existing university structures have in recent years met with relatively little success in developing strong interdisciplinary efforts. Since the initiative for new programs has been vested in departments, there have been relatively few efforts to assemble such groups, to provide them with laboratory facilities, or to assist them with the professional non-professorial staffs essential to such an enterprise.

I do not want to imply that the university has no experience in this area. I have already referred to the interdisciplinary activities established in the early days of the colleges of agriculture. Here, these activities were organized as departments--for example, departments of dairy husbandry, animal husbandry, and horticulture. The very name of the department suggests the problem focus. Some have suggested that we follow the agricultural college pattern of using the college and departmental organization itself to serve this interdisciplinary function. In principle, this could be done, let us say, in a College of Environmental Design, a School of Urban Studies, or a Department of Water Resources, etc. However, in today's world, each of the above problem areas covers a similar if not completely overlapping set of disciplines, such as behavioral sciences, biological sciences, economics, engineering, operations research, etc. Thus, if we were to set up an instructional unit for each mission, we would be adding a similar mix of disciplines in each new field, a costly process that would not be countenanced either by the existing departments responsible for the respective disciplines or by the taxpayers who foot the bill.

If we are to address today's problems within our existing framework, we need interdisciplinary centers in which certain critical conditions are met: (1) We need an environment in which faculty members and students may commit themselves to a joint interdisciplinary effort without making a permanent organizational commitment. We need flexibility in our structure. (2) We need to develop institutional mechanisms for the selection and reward of a new breed of professional academic staff member, one who is not only willing but able to assume leadership roles for interdisciplinary programs.

If there is one overriding staff requirement in an interdisciplinary effort, it is that there be at least one person in a leadership role who is

an interdisciplinary person. And we must recognize that the academic community in its traditional time-honored mold has not addressed itself to the training or education of the interdisciplinary man. A recognized scholar who has devoted his life's career to selecting and solving problems which are tractable by the methods of a single discipline has probably been getting negative experience for addressing problems which in their usual context are either intractable or only partially susceptible to such methods of attack.

If we want true interdisciplinary leaders on our campus, we need a new set of procedures by which to select them, a new set of standards by which to judge them, and a new set of criteria by which to reward them. Under existing structures, we often have no mechanism for hiring such a person if we found one! In most departments, a Wayne Morse, a John Lindsay, or even a John Gardner would not have the appropriate credentials to be considered an acceptable candidate for a tenure position in one of the existing disciplines.

In a departmental structure, when we recruit a young man to a given discipline, we assume that his professional research interests will parallel those of the department for forty years. All too often, a true interdisciplinary person will have professional interests which never parallel the program of any one department. Hence, the entire concept of tenure either for the laboratory director or for the key leadership within the program must be reconsidered. It may be necessary to establish a new category of academic personnel. One proposition which deserves serious consideration is the concept of an all-university professor without tenure. The appointment of such a person might be reconsidered on some periodic basis; perhaps five- or seven-year term would be a suitable one. After one or two terms

of office, the director of such a program might well consider an interim appointment in an academic department, if they would have him; some of the most successful leaders of mission-oriented laboratories have returned to academia for limited periods to renew their intellectual skills or to acquire new perspectives.

Glenn Seaborg recently placed the problem in a larger context. I quote: "Over the next few decades--before the end of this century--mankind will have to face and resolve challenges that may well determine the shape of its life for centuries to come, if not its very surivival." Some have argued that other types of institutions should be engaged in the intellectual effort addressed to such problems. Industry, possessed of some of the most competent administrators and leadership talent, has addressed itself to problems of productivity and distribution, problems which today seem small by comparison with the problems of human survival on this planet. Alvin Weinberg, calling attention to the mismatch between the discipline-oriented structure of the university and the mission-oriented nature of the problems posed by society, has suggested that certain not-for-profit laboratories, such as the national laboratories of the Atomic Energy Commission, should be relied on to work on such problems. It is beyond the scope of this talk to review the adequacy of non-profit corporations for these tasks.

Whether the university is capable of making an important contribution does not depend on whether the public is ready to support such activities, or whether students will be willing to participate; it depends on whether the institution is capable of changing its values and structure in order to do so. Perhaps, as an alternative, we should consider the possibility of new institutional relationships to relate the efforts of universities to those of not-for-profit laboratories and government and industrial laboratories

dedicated to the solution of real problems.

In summarizing my remarks this evening, I hope I have made it clear that I consider that education, research, and public service represent three inseparable aspects of the overall mission of the university.

I have addressed first of all the nature of national objectives for research and development on problems posed by society. In particular, I have tried to characterize the nature of many of those problems which affect the quality of life in America today. Education itself is one of the nation's major distributed national goals. It, too, is characterized by a multiplicity of sponsors and clients. There are 20,000 local school districts and educational institutions in the country and more than 60 million clients--individual students--in formal education alone. As compared with other important problems facing our society, we as a nation have made a remarkably small commitment to research on and development of new and better ways of providing an education. The expansion of this effort continues to be one of the major national needs.

I have turned my attention to the structure of the university and asked whether our present form is appropriate for the functions of a modern university. I have tried to make the case that we must continue the departmental structure to maintain intellectual leadership in the major fields of human knowledge. But I have also made a case for new and more flexible organizations to address problems posed by society. This is one of the most difficult issues facing the administration of this and other campuses. Can new organizational structures be fit into the university in such a way that the interdisciplinary units and the departments may pursue very different objectives without subordinating one administrative structure to the other?

Finally, I have raised a number of questions concerning the life style of our faculty. Can we develop on our campuses mechanisms for developing interdisciplinary capability? Can we train people whose business it will be to think about the questions that cut across specialties, the largest questions facing our society? Our students are asking serious questions about how they may enter into decision-making roles in our society with reference to these important issues. Is the present career pattern calling for ten, fifteen, or twenty years of specialization in a given discipline the only plausible course of professional activity for achieving status in the university? Are there mechanisms by which we can encourage faculty members to explore other career opportunities after they have established themselves in a given discipline? Can we bring into the campus people with experience in industry or government who do not have the credentials of an academic professor?

These are the questions which it seems to me that we must face in considering change on the university campus. I am fully aware that students and the general public alike are asking questions about the governance of the university from a completely different perspective. They are asking how many students should be on each committee or on the governing board of each academic unit. While these are valid questions, it seems to me that we must go on to another set of questions--those that I have raised this evening--before a consensus can be achieved. It seems to me that basic changes in the university will not be made by changing the membership on committees. Nor will valid answers to our most complex problems be attainable unless we seek change in the university in other dimensions as well.

John Gardner put it on the line: "To redesign our society, there is heavy work ahead--work for able and courageous men and women who are willing

to tackle the evils of the day in a problem-solving mood."